Nutrition as a Factor in Physical Development

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EUROPE and America are now confronted with a very serious situation due to the physical deterioration of a large part of their peoples. In America probably half the children of the cities have, or have had rickets. Ninety per cent of all the children of school age are found to have decayed teeth. Over 20 per cent of them are over 10 per cent under the weight normal for their ages, and faulty posture is extraordinarily common. So serious is the condition of malnutrition among school children that a considerable number of organized agencies are now attempting in one way or another to arouse interest among teachers, school authorities and parents with a view to securing greater attention to the correction of physical defects.

There are two schools of active workers interested in the welfare of children at the present time. One of these, and by far the strongest in point of numbers, is the group which holds that the medical and dental clinics are the most important agencies in improving the health of children. According to their view, inspection for the discovery of infected tonsils, adenoids, ear infections or defects of hearing or of vision, faulty posture, decayed teeth and other physical defects, and their prompt and effective treatment, constitute the most effective method of dealing with the problem. They hold that the problem is essentially medical and should remain such.

The other group of workers who are concerned with the improvement of the health of children, favor the establishment of medical and dental clinics, but maintain that the real problem is one of prevention rather than cure. They believe that the underlying cause of the physical inferiority of the present generation of children lies in faulty development, and that the chief factor responsible for this is faulty nutrition, due to unwise selection of food. They admit that diseased tonsils, adenoids or other conditions requiring medical attention, should be treated with dispatch. Decayed teeth are a menace to health and the cause of much discomfort, and early attention by a dentist can, through repair, afford protection to the health of the child and add to its comfort and usefulness. They believe, however, that the removal of the causes of physical inferiority is possible, and that this method alone offers prospect of relief from the burden of the health problems of children, which are now so great that adequate attention to them would constitute an almost intolerable burden in time, labor and money. I shall attempt to present a demonstration that the real problem is in great measure that of securing optimal development in prenatal life and in infancy and early childhood. This conclusion, as well as the conviction that the proper choice of food is the most effective method of achieving the purpose of bringing about better health and better physical development in childhood, has been forced upon me through experience in observing the effects of diets of many different kinds and qualities upon animals, and through a study of human experience with diets of a number of different types.

CAUSES OF MALNUTRITION

There is much misconception in the public mind as to the causes of malnutrition. The discovery of the existence of vitamins during the last decade and their popularization, has overshadowed in importance other dietary problems of as great or greater importance, so that many medical and chemical experts have failed, up to the present time, to see the subject in its proper perspective. "Lack of vitamins" is believed by many to be the most important thing to consider in human nutrition. This view of the subject is too narrow and, owing to its wide-spread prevalence, is likely to do much harm.

The evidence is conclusive that almost all peoples living under primitive conditions are physically well developed. One finds in skeletons of human beings who lived three or four hundred years ago along the Pacific Coast from Alaska to Peru, that there are no evidences of defective development, and that the teeth were essentially perfect. The early inhabitants of Iceland had perfect teeth as did the primitive Eskimo. The teeth of the peoples of Europe and America have deteriorated very rapidly during the last century, and parallel with this deterioration has run a general tendency to inferiority in physical development. The causes for this are not to be summed up in the simple statement, "lack of vitamins." The condition is brought about by a number of defects in the diet, and the remedy is to be found in a wise choice of food, not in taking preparations sold commercially. The logical basis for this conclusion can best be appreciated in the light of a brief account of the newer viewpoints brought to light by modern nutrition investigations.

In the popular mind the most attractive feature of the subject of nutrition during recent times, is the spectacular effect of the lack of a sufficient amount of one or another of at least three chemical substances whose existence was not even suspected a few years ago. The dietary deficiency diseases, scurvy, beri-beri and xerophthalmia of a certain type, result from specific starvation for one or another of these substances. The optimum amount of these three substances in the diet cannot be stated in the light of our present knowledge, but the content of each of them in certain of our more important foodstuffs is sufficiently well known to render it possible to plan diets so as to guarantee a reasonable degree of safety.

Animal experimentation has shown that there are great differences in the biological values of the proteins derived from different sources. This difference depends on the fact that the proteins in different foodstuffs yield varying amounts of the amino-acids or digestion products. If the yields of the several amino-acids is such as to make possible the efficient transformation of food proteins into tissue proteins, the proteins have a high value. If, however, one or more of the amino-acids is present in such small amounts as to make it impossible to utilize the more abundant amino-acids, it forms the limiting factor that determines the value of the protein in nutrition. Many of these digestion products are indispensable in the diet, since they cannot be synthetically produced within the tissues. In considering the value of a natural foodstuff or of a diet consisting of a variety of substances, the idea of quality of protein enters into the calculations of the dietitian of today.

Our knowledge of the great variation in the biological values of proteins from various sources throws a new

light on a possible source of injury to the body tissues. Excessive feeding of proteins is generally held to lay a burden on the organism because of the magnitude of the task of metabolizing the quantity of amino-acids absorbed. From what we know of the intermediate compounds formed in the catabolism of amino-acids, there can be little doubt that some are a physiological abomination, and that dealing with them by the glandular structure is not without a degree of unfavorable effect that in time produces visible alteration in functional capacity. It seems logical to assume that physiological well-being will be best promoted by the employment in the diet of proteins so constituted as to be transformable with little waste into tissue proteins.

THE THREE UNSUSPECTED ESSENTIALS OF DIET

The best analysis of a foodstuff which the chemist is able to make, determines the amounts of protein, carbohydrate (starches and sugars), fats and oils, and mineral salts that it contains. For more than thirteen years it has been known, however, that when a mixture of these substances, each carefully purified, is fed to a young animal, the latter cannot grow or live long. The reason was very difficult to ascertain, for it is due to the lack of certain substances of a moderately unstable nature, the existence of which, as we have pointed out, was not even suspected. Certain species of animals, such as the rat, appear to require, in addition to the long recognized dietary complexes, but two of the unidentified dietary essentials. The most common designation of these is perhaps the term "vitamin," which includes fat-soluble A and water-soluble B. No less than twenty-five names have been invented for these substances. Other species of animals, such as man, guinea-pig and monkey, require three, the additional substance being called water-soluble C. These terms have been applied provisionally, pending the discovery of the chemical natures of these interesting substances.

It is interesting to consider the distribution of the three unknown substances that the diet must contain. The substance, fat-soluble A, is found in butter fat and egg yolk fats, and in the fats from the interior of the cells of the glandular organs of animals, *e.g.*, the liver and kidney, in greater abundance than in any other foods. Leaves of plants constitute the next important source. The seeds, tubers and fleshy roots are all relatively poor in this substance. It has been suggested that among the latter those which contain yellow pigment are richest.

The water-soluble B dietary factor is widely distributed among natural foodstuffs. The only common foods lacking in it are polished rice, the sugars and starches, and the fats and oils from both animal and vegetable sources. Food containing small quantities of it are: white flour, degerminated cornmeal, macaroni, spaghetti and other products prepared principally from bolted wheat flour. All whole seed products, tubers and fleshy roots, leafy foods, milk and eggs contain it in relative abundance. Muscle cuts of meats are very poor in it, but the glandular organs contain it in abundance.

The water-soluble C is abundant only in fresh vegetables, fruits and fresh milk from cows in pasture. Cooked and dried foods have in great measure lost their peculiar dietary properties with respect to this substance.

The effects of specific starvation from one or another of these three

substances are of special interest. Each of them is necessary in the diet in order to prevent the development of a specific syndrome of what we call, collectively, deficiency diseases.

One of the so-called deficiency diseases, which is caused by a lack of fat-soluble A in the diet, is characterized by changes in the eyes, in which edema, inflammation and, in some cases, perforation are the most important. Much remains to be learned regarding the histology and pathology of starvation for this dietary complex. Without it, growth is impossible and death soon intervenes. There is much evidence that a lack of a sufficient amount of fat-soluble A is one of the factors associated with the etiology of rickets.

A lack, either relative or absolute, of the second dietary factor of unknown chemical nature, water-soluble B, leads to the development of a condition of polyneuritis which in man is known as beri-beri. Paralysis is the most striking general feature of the disease. The third of the dietary complexes under consideration is that which prevents the development of the syndrome of scurvy. It is the least stable of the three. The anti-neuritic substance is the most stable.

For several years the three substances just discussed have in the popular mind overshadowed in importance the long recognized dietary essentials. It should be emphasized that there is no basis in fact for considering them any more important than the proteins or than one of the essential mineral elements. All are indispensable components of the diet and are, therefore, of essentially equal importance. Any appraisal of the quality of a diet must include a consideration of the quality and quantity of protein; the content of each of the necessary mineral elements; the content of each of the substances concerned with the etiology of the deficiency diseases, and the availability of the carbohydrates.

DIETARY PROPERTIES OF OUR NATURAL FOODSTUFFS

After the factors which operate to make a diet complete and satisfactory were appreciated, a series of studies was carried out with a view to determining the nature and extent of the dietary shortcomings of each of the more important of our natural foodstuffs. In the light of these studies it has become possible to make certain generalizations of far-reaching importance in the nutrition of man and animals. On these observations is based a new type of classification of the vegetable foodstuffs, depending on the function of the part of the plant from which they are derived.

It has been found that all those parts of plants that have the functions of storage tissues, viz., the seed, tuber and fleshy root, have remarkably similar dietary properties and similar shortcomings. Notwithstanding the great difference between the legume seeds, such as the pea and bean on the one hand and the potato or turnip on the other, they have very nearly the same dietary values in certain respects. All of the cereal grains, legume seeds, tubers and edible roots are deficient in some degree in at least three dietary factors. All contain proteins of relatively poor quality; all contain too little of certain mineral elements, especially calcium, sodium and chlorin, and all are deficient in fat-soluble A. As stated above, there may be a few exceptions to the latter generalization in the case of certain yellow pigmented roots.

The leaf of the plant possesses very different dietary properties from the seed. The palatable leaves are alone

a complete food for those types of animals that have digestive tracts sufficiently capacious to enable them to eat a sufficiently large amount to meet their energy requirements. This superiority in dietary properties correlates with the special function of the leaf as contrasted with the storage tissue, such as the seed, tuber or root. The leaf consists of actively functioning protoplasm supported by skeletal tissue. It is the seat of the synthesis of proteins, carbohydrates and fats. It is the seat of active respiration and metabolism. The seed, tuber and fleshy root represent, on the other hand, packages of reserve food materials, with a few living elements. In general the structures of the storage tissues do not contain all the complexes necessary for the construction of living protoplasm, and are accordingly incomplete foods.

A similar parallel between function and dietary properties can be drawn in the case of the highly specialized muscle tissue on the one hand and the actively metabolizing glandular tissues on the other. The muscle tissue has dietary properties almost identical with those of the seed, tuber or root in all respects except richness of protein. It lacks calcium, sodium and chlorin, fat-soluble A, water-soluble B and water-soluble C. The glandular organs, such as the liver and kidney, are much more complete foods. Indeed, they have all the complexes that are essential for the construction of living tissue, and when supplemented with certain salts, a carbohydrate, such as starch, approximate much more nearly a complete food than would a similar amount of muscle tissue with starch.

SUCCESSFUL DIETS

Since there are closely similar dietary properties in the storage tissues of plants and of muscle tissue of animals, it should be expected that mixtures of these even in considerable numbers should form unsatisfactory diets. In many feeding experiments this has been shown to be the case. Although it is possible for a young animal to grow on a seed, tuber, root and muscle cut of meat diet, its growth is never normal in rate or extent. It will always be stunted and will fall below the normal standard of performance in reproduction and rearing of young, and in span of life.

Consistently unsatisfactory results have been secured on diets consisting of wheat flour, cornmeal, rice, peas, beans, potato, turnip, beet, rolled oats and round steak. The round steak was included to the extent of 10 per cent of the dry matter of the diet.

This leads us to a consideration of diets that succeed in the nutrition of animals. In an extensive inquiry, covering twelve years and based on nearly 4,000 feeding experiments, we have succeeded in nourishing animals in an approximately normal fashion with but three types of diets.

It is possible to select carnivorous foods so as to secure a fairly satisfactory diet entirely derived from animal tissues. Young animals cannot grow or long remain in health when restricted to muscle tissue as their sole food. When blood, liver, kidney and other glandular tissues are selected, together with a certain amount of bone substance, the food supply is sufficiently good to lead to normal development. Muscle tissue must be liberally supplemented with glandular organs to make possible success with the strictly carnivorous diet. The carnivorous diet has been used by man occasionally, the Eskimo and some American Indians being examples.

It has been found possible to sup-

plement the seed, tuber, root and muscle meat type of diet with liberal amounts of the leafy vegetables and secure a fairly satisfactory diet. A liberal supplementing with leaf is required in order to make good the deficiencies of the remainder of the diet. This type of diet is common among the Orientals.

The third type of successful diet is that derived from cereals, legume seeds, tubers and fleshy roots, with or without meats, supplemented with liberal amounts of milk. Milk is so constituted as to make good all the deficiencies of the classes of foods just enumerated.

It is so important to appreciate the special qualities of the leafy vegetables and milk that I have been accustomed to designate these as the protective foods. They are protective because they are especially rich in those elements and complexes in which the storage tissues of plants and muscle tissue are poor.

EXPERIMENTS IN FAULTY NUTRITION

Systematic animal experimentation has revealed data of another kind which is of very great importance to us as an index to the importance of the right selection of food in the promotion of well-being. Such experiments have been undertaken at the author's laboratory to determine how sensitive animals are to diets in which the faults are of a minor character. Hitherto, emphasis has been laid almost entirely upon the "deficiency diseases," scurvy, beri-beri and possibly others, such as pellagra and rickets. The question which we asked ourselves was this: Are there deleterious effects of faulty nutrition caused by diets in which the deficiency is not of a nature or of sufficient gravity to induce a "deficiency disease," but which can be demonstrated in the life history of experimental animals? Is the body immune to faulty diet up to a point of deprivation of one or another dietary essential where the metabolic functions break down and clinically observable effects become apparent?

We have sought to test this proposition by restricting young rats throughout life, and their progeny, if any, throughout several generations, to diets in which the faults were of a very slight nature. A large number of groups of experimental animals were placed upon diets which were of good quality with respect to all factors other than the protein moiety. These were derived from a number of sources and always from a combination of two wholesome natural foods, such as two cereal grains, two legume seeds, a legume seed and an animal tissue, *e.g.*, muscle, kidney, liver, etc. In every case the protein content of the diet was adjusted at 9 per cent of the food mixture. This was done because experience had shown that when the quality of the protein is excellent, this is the smallest amount that will suffice to meet the nutritive needs of the animals during growth, promoting growth at the maximum rate, and support approximately the maximal fertility, making possible the rearing of most of their young. If the proteins of the food are of a quality which might be classed as good rather than excellent, the growth may be normal and the fertility fairly high, but many of the young will be lost during the nursing period. Poor proteins will not support growth at the optimal rate when they constitute but 9 per cent of the food mixture, and the fertility will be low.

In this study we observed, therefore, the effect of a single defect in the diet, and that not of a very pronounced character, on the growth, fertility, infant mortality and tendency to physical

deterioration of families restricted to a monotonous dietary regimen. Observations were also made on the length of life, the age at which the first signs of senility appeared and the effect of the diet on the nervous system of the animal. These afford very interesting data for correlation with human experience.

It was found that a diet may be good enough to enable young animals to grow at the normal rate and to the full adult size, and support fairly high fertility, yet, solely because of the quality and amount of the protein which it contains, the animals may fail to nurse their young successfully to a state of independence. The young may require a nursing period of forty to sixty days instead of the normal twenty-five days before they can be safely weaned, owing to their stunted growth. This long period of nursing is entirely due to failure of the mothers to secrete milk of satisfactory character for the nutrition of their young, because their diet was not properly constituted.

If the quality of the protein in the diet is somewhat below that which would produce the results described in the preceding paragraph, fertility may be lowered, and the mortality of the young born raised even to one hundred per cent. The mortality is from two causes. One group of mother rats destroy their young within a day or two after birth. Female rats are, when well nourished, very solicitous for the welfare of their young, and among such there is practically no infant mortality. The other group will attempt to suckle their litters but allow them to die because of malnutrition.

It is a matter of great importance to have demonstrated that making the diet faulty with respect to protein, but only to an extent which does not interfere with growth or with the maintenance of an apparent state of health in the adult, may profoundly affect the psychology of the animals in respect to so fundamental an attribute of the nervous system as the maternal instinct. Infanticidal tendencies in mothers in this series of experimental animals have been so common and so consistent that there can be no doubt that they had a dietary origin. We are now able to predict with assurance as the result of experience, that on certain diets mother rats will destroy their new-born young.

Perhaps as interesting as any of the results of this series of studies is the effect of faulty diet on the length of time during which the adult animals will maintain the full vigor of middle life, after their growth has been completed, on the experimental diet on which they are maintained throughout life. This may vary greatly. A well nourished rat may live as long as thirty-six months or, in a few instances, a little longer. By making the diet faulty in some degree with respect to the amount or quality of its proteins, we are able to make the span of life almost anything we desire. Rats can be made to grow at the optimal rate and to the full adult size, and appear to be in a satisfactory state of nutrition, yet begin rapidly to deteriorate as soon as growth is completed. Again, they may be made to preserve what appears from their external appearance the full vigor of middle life for a quarter, a third, a half or any other fraction of the extreme span of life which they are capable of living. When the diet is faulty they tend to grow old rapidly.

It is not possible within the limits of space available here to discuss in detail the many interesting observations on this series of experimental animals. This much, however, may be said in

the way of a general conclusion. Any diet which is derived in great measure from cereals, tubers, fleshy roots and muscle cuts of meat (ham, steak, roast) will never be satisfactory for the promotion of growth or for the maintenance of vigor and the preservation of the characteristics of youth.

CALCIUM AS A DIETARY FACTOR

The most important dietary factor concerned with human nutrition or animal production is that relating to the supply of calcium. Not that this element is any more important for nutrition than other indispensable factors, but there is much greater likelihood that the amount of calcium supplied by the food will be inadequate. One hundred grams of wheat contain 0.040 grams of calcium. Our experiments have established very definitely that the optimal concentration of this element for the nutrition of the rat is approximately 0.640 grams per hundred grams of food. This means that unmilled wheat contains but one-fifteenth the amount of calcium which the rat actually needs for optimal nutrition. The blood and other tissues of all mammals contain about the same concentration of this element, and there is much reason to believe that the calcium requirements of man expressed in the per cent of food, are about the same as those of the rat. There are but two classes of foods which are rich in calcium, viz., milk and the leafy vegetables. No combinations of cereals, legume seeds, tubers, fleshy roots, and meats and eggs will supply a sufficient amount of this element.

No combinations of cereal proteins, or of vegetable proteins from any sources, are likely to prove of very high biological value and, since this is true, any attempt to subsist on such a diet would be almost certain to prove a failure. A strictly vegetarian diet would be very deficient in calcium as well as contain proteins of relatively low value, unless it contained a much greater amount of leafy vegetables than are likely to be eaten. It would likewise be deficient in fat-soluble A, the anti-ophthalmic substance, unless the leaf moiety were so great as to be excessive for an alimentary tract of the omniverous type. It would, as would any diet from any source, contain an inadequate amount of the antiscorbutic substance unless it contained some fresh, uncooked articles.

Such a diet as we are discussing would be greatly enhanced with respect to its proteins by the inclusion of meats of any type. If muscle cuts were taken, the supplementary value to the remainder of the diet would be essentially limited to enhancement of the proteins. If, however, glandular organs were employed, as liver, kidney or sweet-bread, the content of the diet in fat-soluble A would be markedly increased. In neither case, however, would there be any increase in the content of calcium as the result of the inclusion of meats.

I have repeatedly asserted, during the last few years, that the white bread and other cereal, muscle meat and potato type of diet which is so common in America and parts of Europe, is causing physical deterioration. No animal can grow satisfactorily on a food supply of this type, nor can one remain long in the possession of full vigor after growth has been attained. Only when such a food supply is supplemented with liberal amounts of milk or the leafy vegetables will it prove satisfactory.

DIETARY FACTORS IN MODERN PHYSICAL DETERIORATION

We are now in a position to understand the reason for the rapid increase

in tooth decay and in faulty skeletal development which has taken place during the past century, and which has been hitherto inexplicable. There has been a rapid and steady increase in the consumption of cereal products during the last century. The consumption of cereal grains in liberal amounts is an inovation in human experience, for cereals could never be cultivated on a large scale until the invention of modern plowing, reaping and threshing machinery. Grass has always been the most serious enemy of agriculture, and only effective implements could cope with it. This is the reason why rice, which developed for a considerable period on flooded land, was the earliest cereal to be widely cultivated.

Not only have we come to consume ever more and more cereal products, but the modern milling industry has furnished us with more and more milled cereal products, such as bolted flour, degerminated cornmeal and polished rice, which are very inferior to the unmilled cereal grains in their dietary properties in respect to several dietary factors. We have simultaneously reduced our consumption of dairy products and green vegetables from the amounts which were taken by people of a century or more ago in many regions of Europe and America where physical development was most satisfactory. These changes are sufficient to account for the deterioration which we are now witnessing. Carniverous man, such as the Eskimo, the Indians of America, the Lapps and the pastoral tribes of Asia and Africa, are highly successful in their nutrition. The Oriental, who eats very liberally of leafy vegetables, bamboo sprouts and weeds which serve as pot herbs, is successful—for reasons which we can now easily explain. The people of Switzerland, Scandinavia, Ireland, parts of Scotland, Iceland and the Hebrides are highly successful with their nutrition because of the large quantities of dairy products which they consume. In England, parts of Scotland and many places on the Continent, as well as in tens of thousands of homes in America, where the meat, bread and potato type of diet is the rule and where little milk or green vegetables are eaten, physical degeneration has resulted and is further in progress.

In the light of modern knowledge of nutrition this physical degeneration may be safely attributed to faults in the diet of the pregnant mother which prevent her from doing the best possible by her unborn baby. She tries to nurse the child on a diet which does not permit her to secrete milk of a satisfactory quality for the nutrition of the child. Before the child is many months old it is shifted to artificial feeding, in which milk is modified by one of the many methods recommended by physicians. These involve dilution and adjustment with sugar or cereal waters, and provide a food which fails to furnish the proper relations between certain mineral elements, especially calcium and phosphorus. Cereals are introduced as early as possible into the infant's diet under the mistaken idea that these are foods of a highly satisfactory sort. Actually, they are not so constituted as to promote growth at all, except as they are enhanced by the other constituents of the diet. It is under such conditions that rickets and related skeletal defects develop. The concomitants of rickets are flabby and weak musculature, tendency to faulty posture, distention of the intestine with gas and general malnutrition.

Rickets has been shown experimentally in the author's laboratory to be due to faulty diet, and it has been

conclusively demonstrated that three factors are especially concerned with its etiology. These are the calcium and phosphorus content, and the content of a certain vitamin, which is possibly identical with fat-soluble A. When there is an abnormal proportion between the calcium and phosphorus in the diet and a relative shortage of the organic factor mentioned, rickets will develop. The great frequency of the development of rickets in infants shows how frequently these errors in the diet are being realized in general experience.

THE TEETH

But the teeth are a part of the skeleton and their development is governed by the same laws that govern the growth of the bones. The diet must be nicely adjusted or they will undergo faulty development. The enamel is put on the teeth before they are erupted. It is not deposited simultaneously in a uniform layer over the tooth, but at certain centers of enamel formation. One of these is situated at the apex of each of the cusps of a molar and from these points the enamel spreads until the several areas meet in the sulci. Here they must form a perfect union if the tooth is to be long lived and free from decay. Actually, there are now common defects in the enamel and it is often not sufficiently dense and thick to form a satisfactory covering for the tooth. Furthermore, under faulty conditions of nutrition, the roots fail to develop as they should. We thus form teeth which are vulnerable because not normally developed. The developmental factor is the most important one from the standpoint of preventive dentistry. It is of the utmost importance that a good dental apparatus should be formed. Teeth of optimal development possess their own defensive barriers, and can withstand abuse without undergoing destruction by caries.

The idea of mouth hygiene and early repair of the teeth has been overworked in recent years. The slogan that a clean tooth never decays is perhaps theoretically true, but it is an utter impossibility to keep the teeth in a condition of bacteriological cleanliness. Actually, therefore, this slogan is false and misleading. Any system of preventive dentistry which ignores the developmental factor has a fundamental weakness. The real basis of preventive dentistry is proper nutrition of the pregnant mother, and a better system of feeding infants and young children than is now in vogue. The formation of an effective and properly fortified set of teeth is largely a matter of right living during the first five or six years of life, for after a tooth has erupted its improvement is not possible, or is possible only to a very slight extent. The critical time is while the tooth is forming.

I have discussed at length, elsewhere,[1] the knowledge of nutrition which has been gained through animal experimentation, and also the results of an extensive study of the experience of man in different parts of the world with diets of different types. The results of these two lines of investigation correlate in a surprising fashion, and form convincing evidence that it is time that the sociologist and the economist as well as the medical man and the health worker, should awaken to the possibilities for human betterment which can be achieved through education in matters relating to nutrition.

[1] *The Newer Knowledge of Nutrition.* New York, 1921. 2nd. ed.